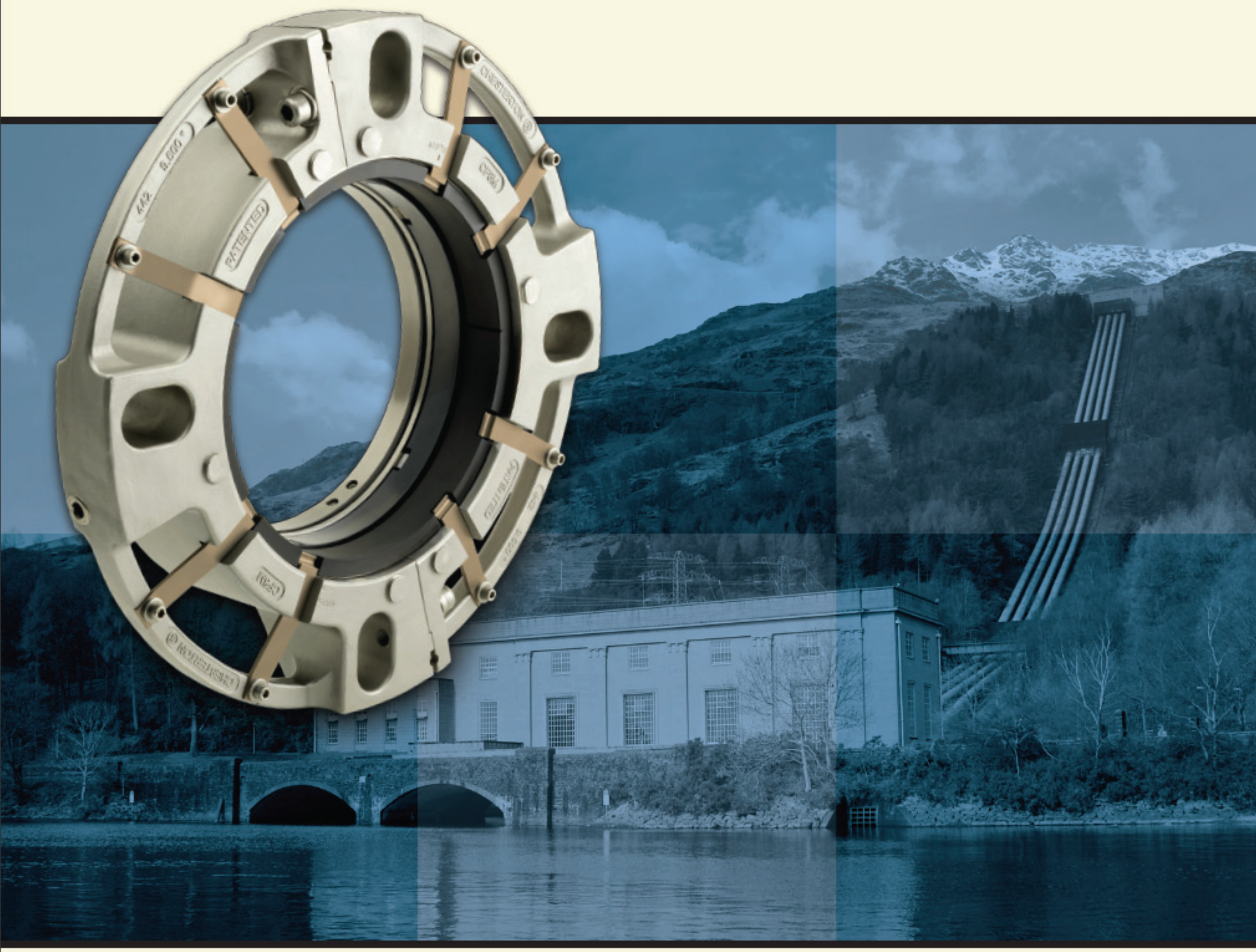
HYDROPOWER

SPLIT MECHANICAL SEALS FOR WATER TURBINE MAIN SHAFT SEALING

INNOVATIVE, PROVEN TECHNOLOGY FOR RELIABLE, MAINTENANCE-FREE SEALING



CHESTERTON®
Global Solutions, Local Service.

Large Turbines Create Large Sealing Problems

Many factors affect reliable turbine main shaft sealing. Shaft size, turbine speed, pressure, water sediment content, start-up conditions, cavitation, vibration, and other factors will impact seal selection and the long-term success of the sealing device. Legacy main shaft sealing devices were designed a century ago based on available technology, and it is surprising that these seal designs are still the primary seals used today!

Typical leakage can be minimized or eliminated using Chesterton split mechanical seal technology

Fortunately, there has been a significant advance in sealing technology and material science which has expanded sealing capabilities that can be applied to turbine main shaft sealing.

Utilizing innovative seal technology and materials, understanding sealing principles, and having the knowledge of turbine operating conditions will lead to better sealing systems for turbine main shafts. Seal leakage can be significantly reduced or eliminated, the effects of sedimentation on the sealing device can be mitigated, and operating and maintenance costs related to the main shaft seal can be dramatically reduced. In turn, longer and more reliable sealing can be achieved.

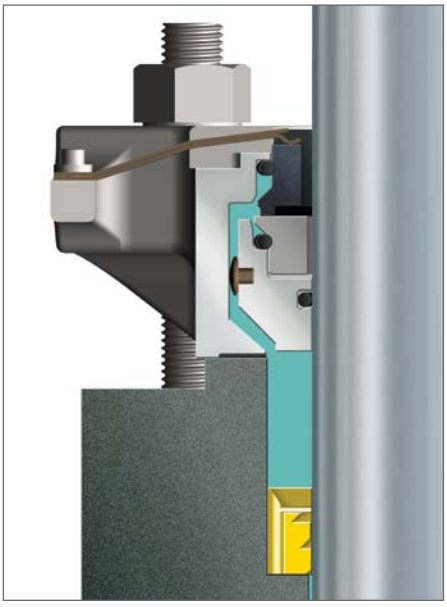
Leakage leads to equipment corrosion, but also to maintenance challenges. Seal accessibly is a significant problem with many water turbine designs.

Conventional sealing can lead to:

- Sleeve wear
- Excessive leakage
- Auxiliary pumps needed to control leakage
- Seal adjustments and unplanned maintenance
- Sealing element wear
- Collateral equipment damage
- Downtime and production loss
- Increased operating costs

Solutions for the Hydropower Industry– Split Mechanical Seals

CHESTERTON® is the global leader in innovative, value-driven sealing device products. Our split seals for turbine main shafts are designed to seal without leakage, minimizing the problems associated with it. Our innovative technology has expanded split seal use in large, rotating equipment, thus simplifying installation, improving reliability, and extending performance capabilities.



Chesterton split seals use abrasion-resistant face materials to mitigate seal wear typically associated with main shaft turbine seals. SpiralTrac™ bushings prevent particulates from reaching the seal, enhancing seal reliability and extending seal life.

Why use Chesterton Split Seals?

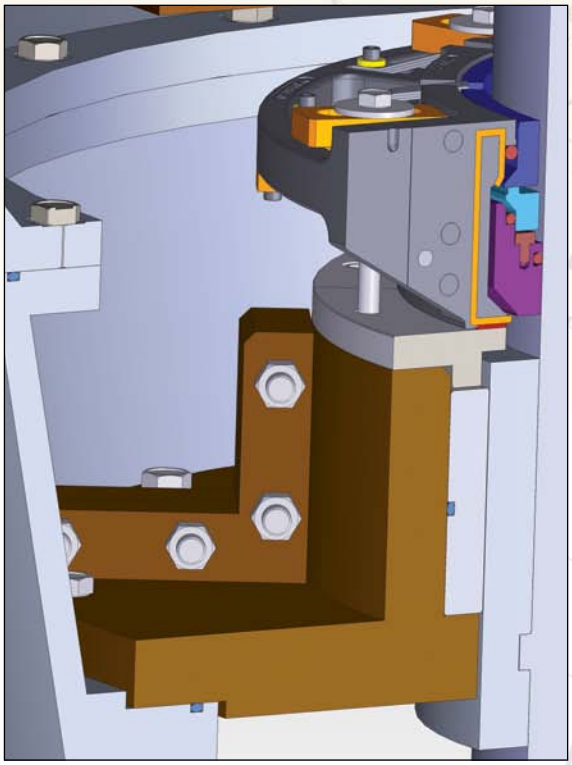
- Abrasion-resistant face materials mitigate wear associated with silt and sand
- Minimize or eliminate seal leakage
- Reduce flush water usage and filtration requirements
- Simple installation
- No packing maintenance or break-in requirements
- Eliminate shaft/sleeve wear
- Proven technology with years of reliable operation
- Cut maintenance and operating costs
- Field repairable
- Reduce or eliminate secondary pumping equipment required to control seal leakage

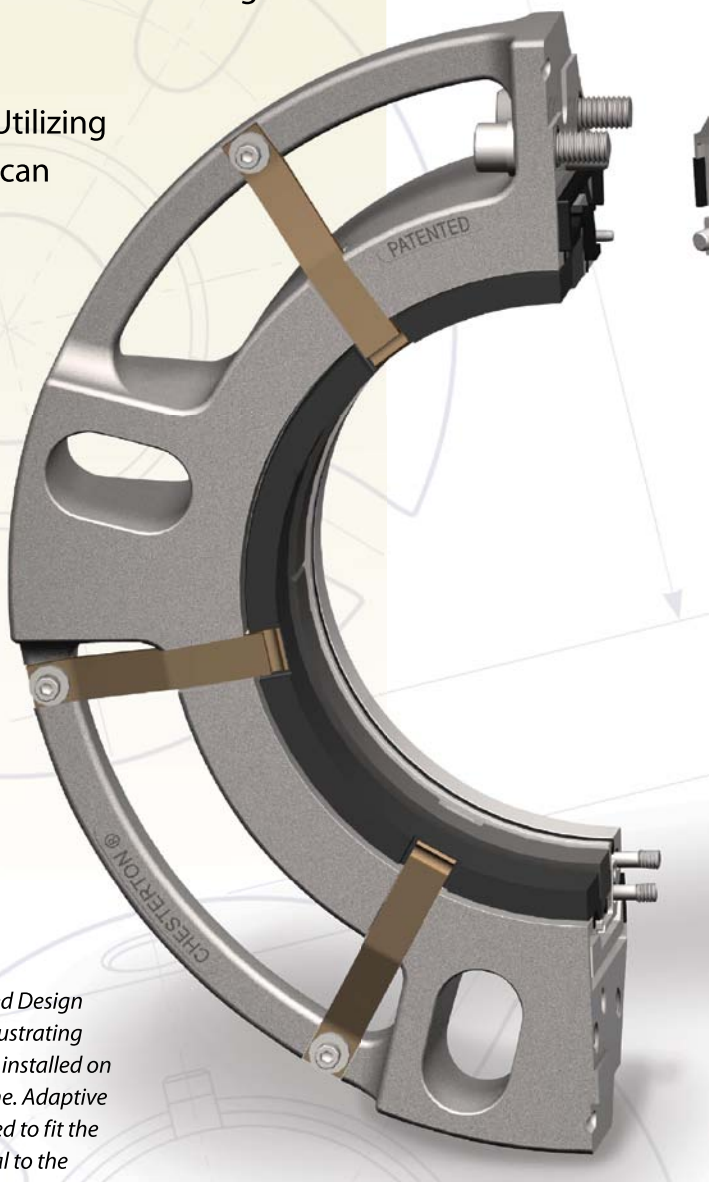
SpiralTrac™ is a trademark of EnviroSeal Engineering Products Ltd.

Break the Paradigm…

Conventional main shaft turbine seals are designed to leak and, in most cases, wear the sleeve they seal against. They also require clean, filtered water that is flushed within the seal to prevent solids from embedding between the sealing elements and the sleeve.

Chesterton split seals are designed to seal leak-free. Utilizing our innovative technology and sealing materials, we can deliver superior sealing solutions that address the dynamics of your operation and develop reliable, long-term solutions that significantly reduce filter water requirements.





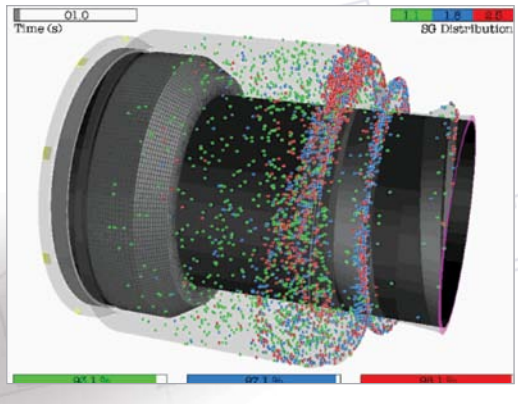
Computer-Aided Design (CAD) model illustrating a 442 Split Seal installed on a Francis turbine. Adaptive hardware is used to fit the mechanical seal to the turbine without equipment modification.

Reduce Filtration Dependency

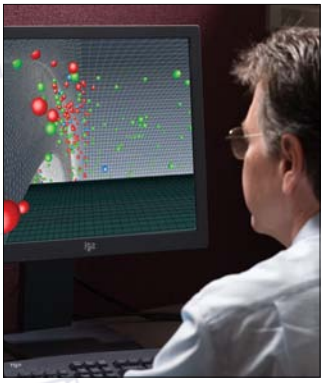
One of the greatest challenges in developing a reliable sealing solution for water turbines is keeping sediment and sand from the seal so that the particulate doesn't clog or wear the seal or equipment.

Expensive and maintenance-intensive filtering systems are needed to filter water used to flush conventional sealing devices to prevent particulate from contaminating the seal environment. The reliability and life of your seal is directly dependent on the continual operation of the filtering systems. They must be capable of delivering continuous filtered water to overcome seal leakage and pressure conditions.

Environmental controls and secondary sealing devices play an important role in achieving reliable, long-term sealing. Chesterton can integrate split seals with SpiralTrac™ technology to eliminate solids from the sealing environment and significantly reduce or eliminate flush water requirements necessary for turbine main shaft seals. Controlling the adverse conditions in which the seal typically operates will improve your sealing system reliability and reduce operating costs.



Computational modeling can determine the effectiveness of the SpiralTrac environmental controller in eliminating sediment from the turbine main shaft seal at significantly reduced seal flush rates.



SpiralTrac™ is a trademark of EnviroSeal Engineering Products Ltd.

Chesterton, your global partner

Our knowledgeable specialists, engineers, and service teams will work with you to deliver the best total sealing solutions for your critical hydropower equipment. By understanding the dynamics of your process and individual needs, Chesterton will help you develop successful, long-term sealing solutions.

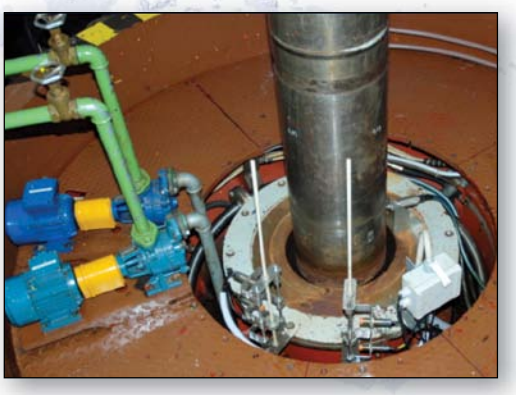
United States

Equipment 12 MW Water Turbine, 100 rpm at 2 bar g (30 psig)

Problem Main shaft vibration problems accelerated packing leakage to an unacceptable level. Other split seal designs did not work either.

Solution 610 mm (24 inch) split seal eliminated water leakage, the constant packing maintenance, and pen stock pumping required.

Seal has been in service for over 9 years.



Czech Republic

Equipment 1.5 MW Francis Turbine, 1000 rpm at <1 bar g (15 psig)

Problem Segmented carbon seals experienced excessive leakage, leading to premature bearing failure and poor reliability.

Solution 280 mm (11 inch) split seal eliminated the excessive leakage.

Seal has been in service for over 16 years.

in total sealing solutions

Germany

Equipment Kaplan Turbine, 40 rpm at 0.4 bar g (6 psig)

Problem The segmented carbon seal leaked excessively, leading to premature bearing failure and poor reliability.

Solution 280 mm (11 inches) split seal eliminated water leakage and the bearing failures due to leakage.

Seal has been in service for over 9 years.

Italy

Equipment 1.6 MW Francis Turbine, 1000 rpm at 1 bar g (<15 psig)

Problem Mechanical packing using a flush experienced significant leakage which lead to equipment corrosion and premature bearing failure.

Solution 270 mm (10.5 inches) split seal eliminated all leakage.

Seal has been in service for over 5 years.

Norway

Equipment 1.9 MW Francis Turbine, 800 rpm at 2 bar g (29 psig)

Problem Mechanical packing with flush leaked excessively, raising powerhouse flooding concerns and bearing failure.

Solution 285 mm (11.25 inches) split seal eliminated all leakage, reducing secondary pumping requirements and the premature bearing failures.

Seal has been in service for over 22 years.

CHESTERTON

Innovative Solutions for the Hydropower Industry

Mechanical Packing

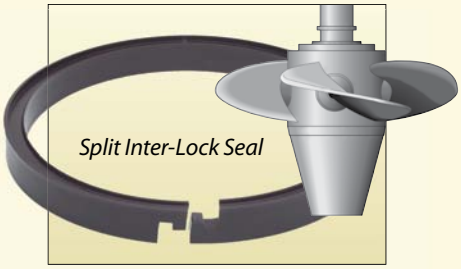
Chesterton is a global leader in the design and manufacture of mechanical packing for main shaft sealing where turbine design or user preference warrants.

Engineered Polymer Seals

Blade Runners

The *Split Inter-Lock Seal* is specifically designed to address blade droop and associated issues commonly found with Kaplan turbines. The exclusive seal design resists rotary motion from pulling the splits apart and utilizes load pressure to join and create a positive seal at cut ends.

- Superior performance improves turbine effectiveness
- Eliminates oil loss and downstream leakage
- Effectively seals blade droop and associated issues
- Split design is field serviceable and minimizes downtime



Wicket Gates

Thermal expansion and a contraction of horizontal cylinders can cause premature failure of OEM seal designs. Chesterton's advanced thermoset polymer seals are designed to overcome these issues and have proven to substantially increase cylinder reliability, helping to maximize the power and speed of your equipment.

GLOBAL SOLUTIONS, LOCAL SERVICE

Since its founding in 1884, the A.W. Chesterton Company has successfully met the critical needs of its diverse customer base. Today, as always, customers count on Chesterton solutions to increase equipment reliability, optimize energy consumption, and provide local technical support and service wherever they are in the world.

Chesterton's global capabilities include:

- Servicing plants in over 100 countries
- Global manufacturing operations
- More than 500 Service Centers and Sales Offices worldwide
- Over 1200 trained local Service Specialists and Technicians

Visit our website at www.chesterton.com

Learn more about the proven solutions Chesterton has to offer!

KEEPING THE PLANET CLEAN CHESTERTON

Chesterton ISO certificates available on www.chesterton.com/corporate/iso

SpiralTrac™ is a trademark of EnviroSeal Engineering Products Ltd.
TECHNICAL DATA REFLECTS RESULTS OF LABORATORY TESTS AND IS INTENDED TO INDICATE GENERAL CHARACTERISTICS ONLY.
A.W. CHESTERTON COMPANY DISCLAIMS ALL WARRANTIES EXPRESSED, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR USE. LIABILITY, IF ANY, IS LIMITED TO PRODUCT REPLACEMENT ONLY. ANY IMAGES CONTAINED HEREIN ARE FOR GENERAL ILLUSTRATIVE OR AESTHETIC PURPOSES ONLY AND ARE NOT INTENDED TO CONVEY ANY INSTRUCTIONAL, SAFETY, HANDLING OR USAGE INFORMATION OR ADVICE RESPECTING ANY PRODUCT OR EQUIPMENT. PLEASE REFER TO RELEVANT MATERIAL SAFETY DATA SHEETS, PRODUCT DATA SHEETS, AND/OR PRODUCT LABELS FOR SAFE USE, STORAGE, HANDLING, AND DISPOSAL OF PRODUCTS, OR CONSULT WITH YOUR LOCAL CHESTERTON SALES REPRESENTATIVE.

CHESTERTON®
Global Solutions, Local Service.

DISTRIBUTED BY:

860 Salem Street
Groveland, MA 01834 USA
Telephone: 781-438-7000
Fax: 978-469-6528
www.chesterton.com

© A.W. Chesterton Company, 2012. All rights reserved.
® Registered trademark owned and licensed by A.W. Chesterton Company in USA and other countries, unless otherwise noted.

FORM NO. EN22881

PRINTED IN USA 05/12